

CLAIMS

1. An identification tag (100) for use in a system (400) for determining the position of the identification tag (100), which may be in motion in a room in a building or other areas to be monitored,
5 characterised in that the identification tag (100) comprises an ultrasonic transducer (190) connected to a transmitter (180) adapted to transmit ultrasonic signals, together with a radio transmitter (170) and radio receiver (175) connected to an antenna (195) for transmitting and receiving radio signals containing the identity of the identification tag
10 (100).
2. An identification tag (100) according to claim 1,
characterised in that it comprises a control unit (160) adapted to control the transmission of ultrasonic signals and radio signals.
3. An identification tag (100) according to claims 1 and 2,
15 characterised in that the radio receiver (175) is connected to the control unit (160) and arranged to receive radio messages from other identification tags (100).
4. An identification tag (100) according to claims 1 and 2,
20 characterised in that the radio receiver (175) is connected to the control unit (160) and arranged to receive radio messages from master units (200).
5. An identification tag (100) according to claim 1,
25 characterised in that the radio transmitter (170) is connected to the control unit (160) and adapted to transmit radio messages to master units (200).
6. An identification tag (100) according to claims 1 and 2,
30 characterised in that it further comprises a sabotage unit (110) connected with the control unit (160) for detecting any attempt to remove and/or open the identification tag (100), and where, after such detection, the control unit (160) is adapted to add such additional information to the radio signal transmitted from the identification tag (100).
7. A stationary master unit (200), specially adapted to a system (400) for position determination of objects which may be in motion,
35 characterised in that it comprises:
- an ultrasonic transducer (265) for receiving ultrasonic signals in the form of ultrasonic pulses, together with a radio transmitter unit (275) and

a radio receiver unit (270) connected to an antenna (295) for transmitting and receiving information from an identification tag (100) according to claims 1-6,

- a receiver unit (260) for detecting ultrasonic pulses transmitted from the identification tag (100),

- signal processing means (230) for receiving and interpreting radio signals, and for executing the following steps for processing the received ultrasonic pulses:

- calculating transit time differences for received ultrasonic pulses transmitted from the identification tag (100),

- transmitting to a central processing unit (410) via a network (215) data containing transit time differences for received ultrasonic pulses, an identification of the room in which it is located, and the identification of the identification tag (100).

8. A system (400) for determining the position of at least one identification tag (100),

characterised in that it comprises:

- at least one identification tag (100) according to claims 1-6,

- one or more master units (200) according to claim 7 for detecting transit time differences for the ultrasonic pulses transmitted from the identification tag (100),

- one or more slave units (300) with means for receiving ultrasonic signals in the form of ultrasonic pulses, means for detecting ultrasonic pulses transmitted from the identification tag (100), means for measuring transit time differences for received ultrasonic pulses, together with means for transmitting this information to master units (200),

- a network (215) interconnecting several slave units (300) and master units (200),

- at least one central processing unit (410) for collecting, interpreting and processing data transmitted from master units (200),

- a network (215) interconnecting several master units (200) with the central processing unit (410), and

- processing means in the central processing unit (410) for determining the position of a transmitter unit (100).

9. A system according to claim 8, characterised in that the network connection (215) interconnecting stationary slave units (300) and master units (200) is radio-based.

10. A system according to claim 8, characterised in that the network connection (215) interconnecting stationary slave units (300) and master units (200) is wire-based.

11. A system according to claim 8,
characterised in that the connection between master units (200) and the
central processing unit (410) is based on radio waves.
12. A system according to claim 8,
characterised in that the connection between master units (200) and the
central processing unit (410) is wire-based.
13. A method for determining the position of one or more objects which may
be in motion in a room in a building or other areas,
characterised in that the method comprises:
a) employing an identification tag (100) according to claims 1-6 to listen
for radio messages,
b) transmitting a radio message from the identification tag (100) with a
request for permission to transmit ultrasonic pulses,
c) receiving a radio message from other identification tags (100) if they
are simultaneously executing transmission of ultrasonic signals,
d) transmitting an ultrasonic pulse from the identification tag (100) while
it simultaneously transmits a radio signal, if it has not received a radio
message telling that other identification tags (100) are transmitting,
e) receiving the ultrasonic pulse from the identification tag (100) on one
or more master units (200) and slave units (300), while master units (200)
are also simultaneously receiving a radio signal from the identification
tag (100),
f) receiving the radio signal from the identification tag (100) on a master
unit (200),
g) calculating transit time differences for received ultrasonic pulse on
master units (200) and slave units (300),
h) transmitting information on transit time differences from slave units
(300) to master units (200),
i) transmitting information on transit time differences, identification of
room and radio signal information received in master units (200) from
slave units (300) and identification tag (100) to a central processing unit
(410),
j) calculating the position of the identification tag (100) which
transmitted the ultrasonic pulse on the basis of the identification of the
identification tag (100) and transit time differences of transmitted
ultrasonic pulse from the identification tag (100), together with
knowledge of the position of each individual master unit (200) and slave
unit (300) in each room or area.
14. A method according to claim 13,
characterised in that the radio message to which the identification tag

(100) listens contains information concerning which ultrasonic frequency or coding is employed by other identification tags (100) which are currently transmitting ultrasonic pulses.

- 5 15. A method according to claim 13,
 characterised in that the request in the form of a radio message from the
 identification tag (100) is transmitted when the identification tag (100) is
 set in motion.
- 10 16. A method according to claim 13,
 characterised in that the request in the form of a radio message from the
 identification tag (100) is transmitted after a preset period.
17. A method according to claim 13,
 characterised in that the request in the form of a radio message from the
 identification tag (100) is transmitted when parts of the identification tag
 (100) are exposed to light.
- 15 18. A method according to claims 13 and 14,
 characterised in that the frequency or coding of the ultrasonic pulse
 employed by the identification tag (100) is different to that currently
 employed by other identification tags (100).
- 20 19. A method according to claim 13,
 characterised in that the radio signal transmitted from the identification
 tag (100) while it simultaneously transmits an ultrasonic pulse contains
 the identification number and ultrasonic frequency or coding employed
 by the identification tag (100).
- 25 20. A method according to claim 19,
 characterised in that the radio signal transmitted from the identification
 tag (100) may further contain additional information, such as that an
 attempt has been made to remove the tag.